FIG. 1
(PRIOR ART)

DOWNSTREAM : BROADCAST
UPSTREAM : TDMA (TIME DIVISION MULTIPLE ACCESS)

FIG. 2A
(PRIOR ART)

OPTICAL SIGNAL POWER

VARIABLE TRIGGER LEVEL

OUTLINE OF BURST DATA (ATM CELL)

HIGH TRIGGER LEVEL

MIDDLE TRIGGER LEVEL

INPUT SIGNAL

BURST FROM ONT w   BURST FROM ONT x   BURST FROM ONT y   BURST FROM ONT z   TIME

FIG. 2B
(PRIOR ART)

CASE (a): OUTPUT DATA- HIGH TRIGGER LEVEL

0 1 0 1 0

TIME

FIG. 2C
(PRIOR ART)

CASE (b): OUTPUT DATA- MIDDLE TRIGGER LEVEL

TIME

FIG. 2D
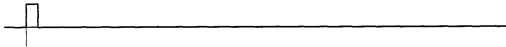(PRIOR ART)

CASE (c): OUTPUT DATA- VARIABLE TRIGGER LEVEL

TIME

FIG. 3A

[1] DOWNSTREAM FRAME BOUNDARIES

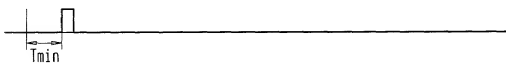## FIG. 3B

[2] DOWNSTREAM RANGING PLOAM CELL
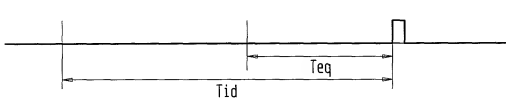
FIG. 3C

[3] UPSTREAM RANGING REPLY CELL (Td=0)

Tmin

FIG. 3D

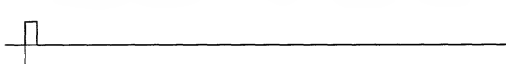[4] UPSTREAM RANGING REPLY CELL (Td>0)
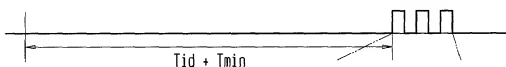
Td

FIG. 3E

[5] UPSTREAM CELL AFTER RANGING

Teq

Tid

FIG. 3F

[6] DOWNSTREAM PLOAM CELL WITH GRANTS IN 1st,2nd,3rd TIME SLOT

FIG. 3G

[7] 3 UPSTREAM CELL IN 1st,2nd,3rd TIME SLOTS AFTER RANGING

Tid + Tmin

FIG. 3H

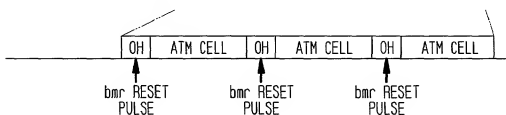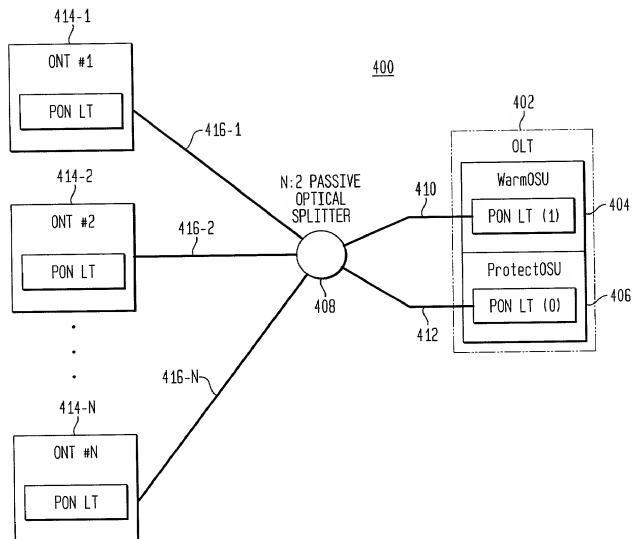[8] EXPANSION OF 3 UPSTREAM CELLS SHOWING POSITION OF bmr RESET PULSE

| OH | ATM CELL | OH | ATM CELL | OH | ATM CELL |

bmr RESET
PULSE

bmr RESET
PULSE

bmr RESET
PULSE

FIG. 4

OLT-ONLY DUPLEX SYSTEM

FIG. 5

520

ONT #1
- 522 — PON LT (1)
- 524 — PON LT (0)

-526

514   528

ONT #2
- PON LT

518 — 516

ONT #N
- PON LT (1)
- PON LT (0)

500

2N:2
SPLITTER

DOUBLE N :2 OPTICAL SPLITTER

DOUBLE 2:1 OPTICAL SPLITTER

510

512

508

502

OLT

WarmOSU
- PON LT (1) — 504

ProtectOSU
- PON LT (0) — 506

PARTIAL DUPLEX SYSTEM

FIG. 6

608 FAILURE

BETA CONSECUTIVE
FAILED DELINEATION

BIT-BY-BIT

602 HUNT

SUCCESSFUL DELINEATION

ALPHA CONSECUTIVE
FAILED DELINEATION

FAILED DELINEATION

PRESYNC   SLOT-BY-SLOT

604

SYNC

DELTA CONSECUTIVE
SUCCESSFUL DELINEATION

606

SLOT-BY-SLOT

FIG. 7A

700

RX_BMR_DATA ← | BURST MODE RECEIVER | ← RX_OPT_SIGNAL

BMR_RESET →

FIG. 7B

TIMING REFERENCE AT WarmOSU
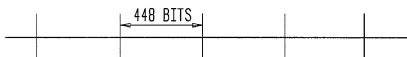
448 BITS

FIG. 7C

RX_OPT_SIGNAL (OPTICAL SIGNALS RECEIVED BY BURST MODE RECEIVER)

OPTICAL POWER DIFFERS
FOR EACH ONT's CELLS

FIG. 7D

BMR_RESET (BURST MODE RECEIVER
RESET SIGNALS-SPACED OUT BY 449/448 BITS)

449 BITS   449 BITS   449 BITS   448 BITS   448 BITS
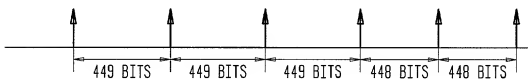
FIG. 7E

RX_BMR_DATA (OUTPUT OF BURST MODE RECEIVER)

| UNRECOGNIZED DATA TRANSITIONS (GARBAGE) | ATM CELL | ATM CELL |

FIG. 8A

FLUCTUATION

DELIMITER

PREAMBLE

FIG. 8B

RESET
PULSE

CORRECT
POSITION

SEARCH
WINDOW

1 BIT   449 BITS   1 BIT   449 BITS   449 BITS
         (1st TRIAL)   (447th TRIAL)   (448th TRIAL)

FIG. 9A

FLUCTUATION

PREAMBLE DELIMITER

| P | D | | P | D | | P | D |

RESET
PULSE

SEARCH
WINDOW

| 449 BITS | 448 BITS | 449 BITS |
| (FAILED DELINEATION) | (SUCCESSFUL DELINEATION) | (FAILED DELINEATION) |

FIG. 9B

| 448 BITS | 448 BITS | 448 BITS |
| (SUCCESSFUL DELINEATION) | (SUCCESSFUL DELINEATION) | (SUCCESSFUL DELINEATION) |

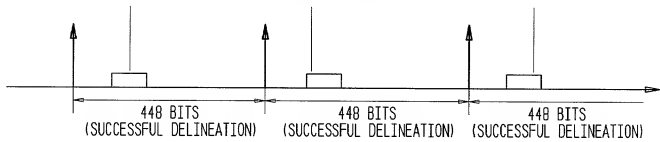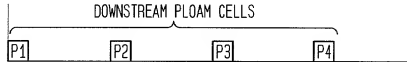## FIG. 10A
FRAME BOUNDARIES ON WarmOSU AND ProtectOSU (SYNCHRONIZED)

SOF   SOF

FIG. 10B
DOWNSTREAM PLOAM CELLS (PL1 CONTAINS PLOAM GRANT FOR ONT #1)

DOWNSTREAM PLOAM CELLS

| P1 | | P2 | | P3 | | P4 |

FIG. 10C
UPSTREAM RECEPTION OF PLOAM CELL FROM ONT #1 (Td1, Td2=0)

UPSTREAM PLOAM CELLS BY ONT#1

RECEIVED AT WarmOSU,
ProtectOSU (Td1, Td2=0)
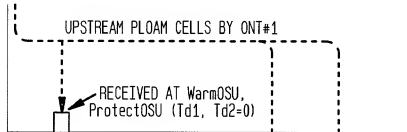
FIG. 10D
UPSTREAM RECEPTION OF PLOAM CELL FROM ONT #1 (Td1>0) AT WarmOSU

RECEIVED AT
WarmOSU
(Td1>0)

FIG. 10E
UPSTREAM RECEPTION OF PLOAM CELL FROM ONT #1 (Td2>0) AT ProtectOSU

Td1

RECEIVED AT
ProtectOSU
(Td2>0)

Td2   D2
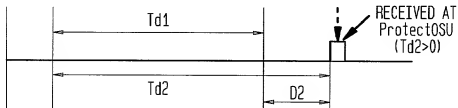
Td1: DELAY MEASURED AT WarmOSU
Td2: DELAY MEASURED AT ProtectOSU
D2: TIME DIFFERENCE BETWEEN START OF FRAME IN WarmOSU AND ProtectSU,
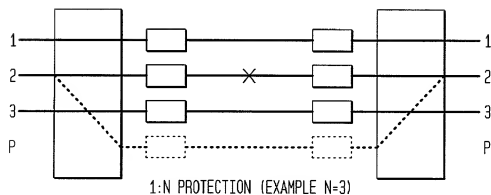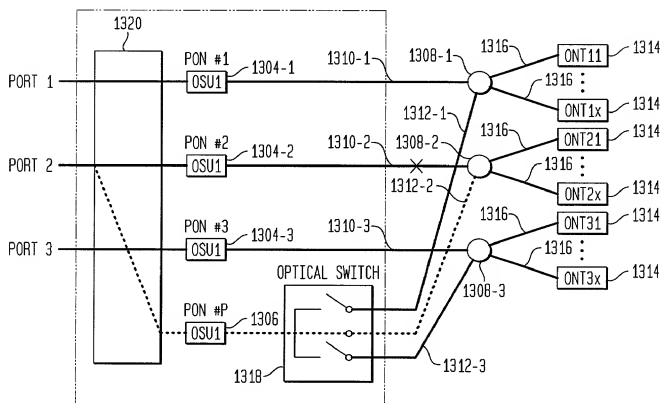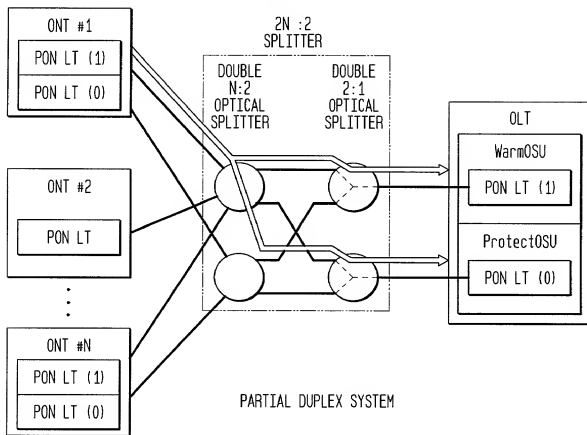DUE TO DIFFERENCE IN DISTANCE TO SPLITTER
*SOF: START OF FRAME

FIG. 11

1:N PROTECTION (EXAMPLE N=3)

FIG. 12

FIG. 13

PARTIAL DUPLEX SYSTEM

FIG. 14

PARTIAL DUPLEX SYSTEM